NSF Elementary Particle Physics

Report on NSF Funding

Presentation at the HEPAP Meeting

September 23, 2004

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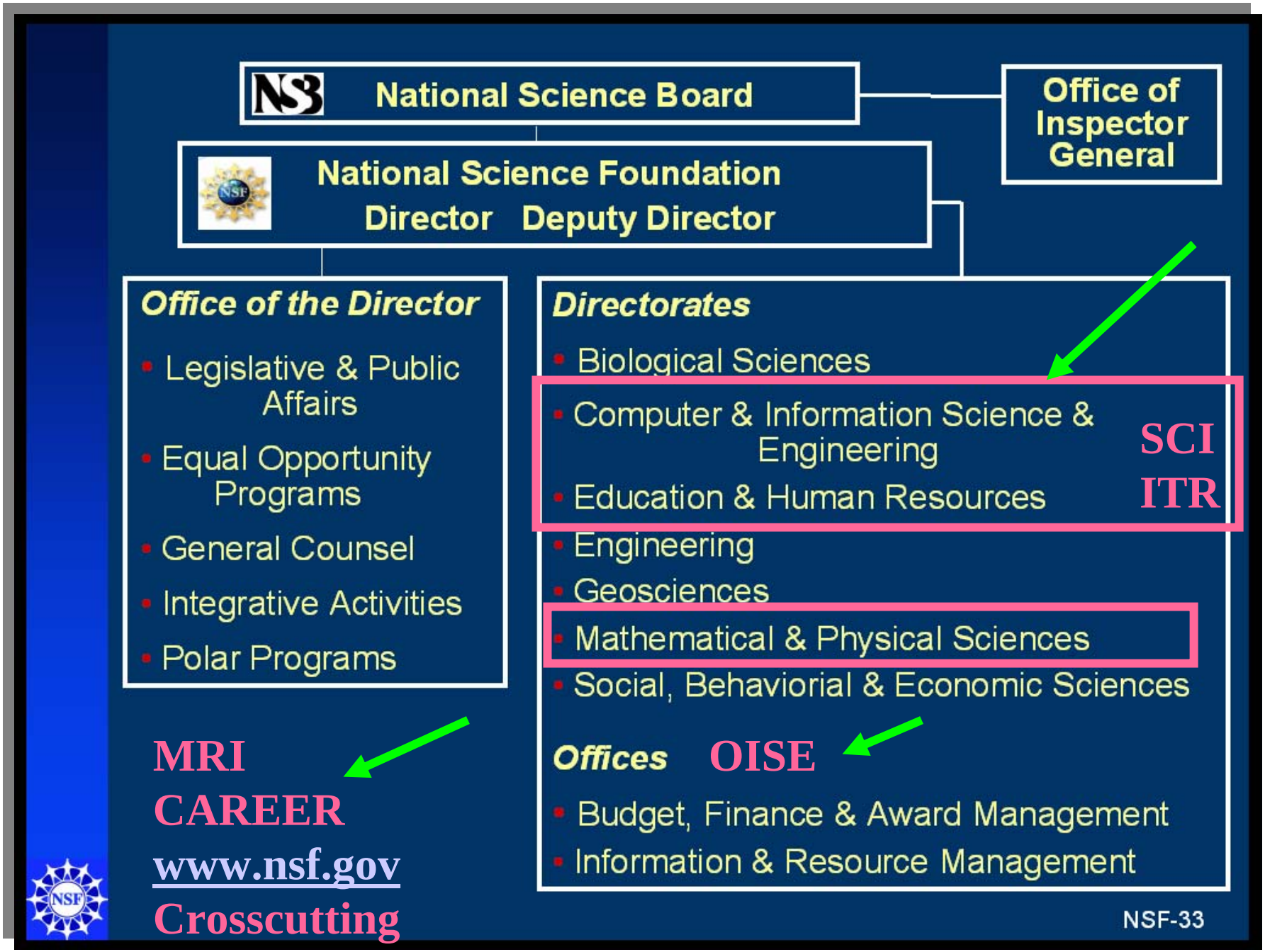
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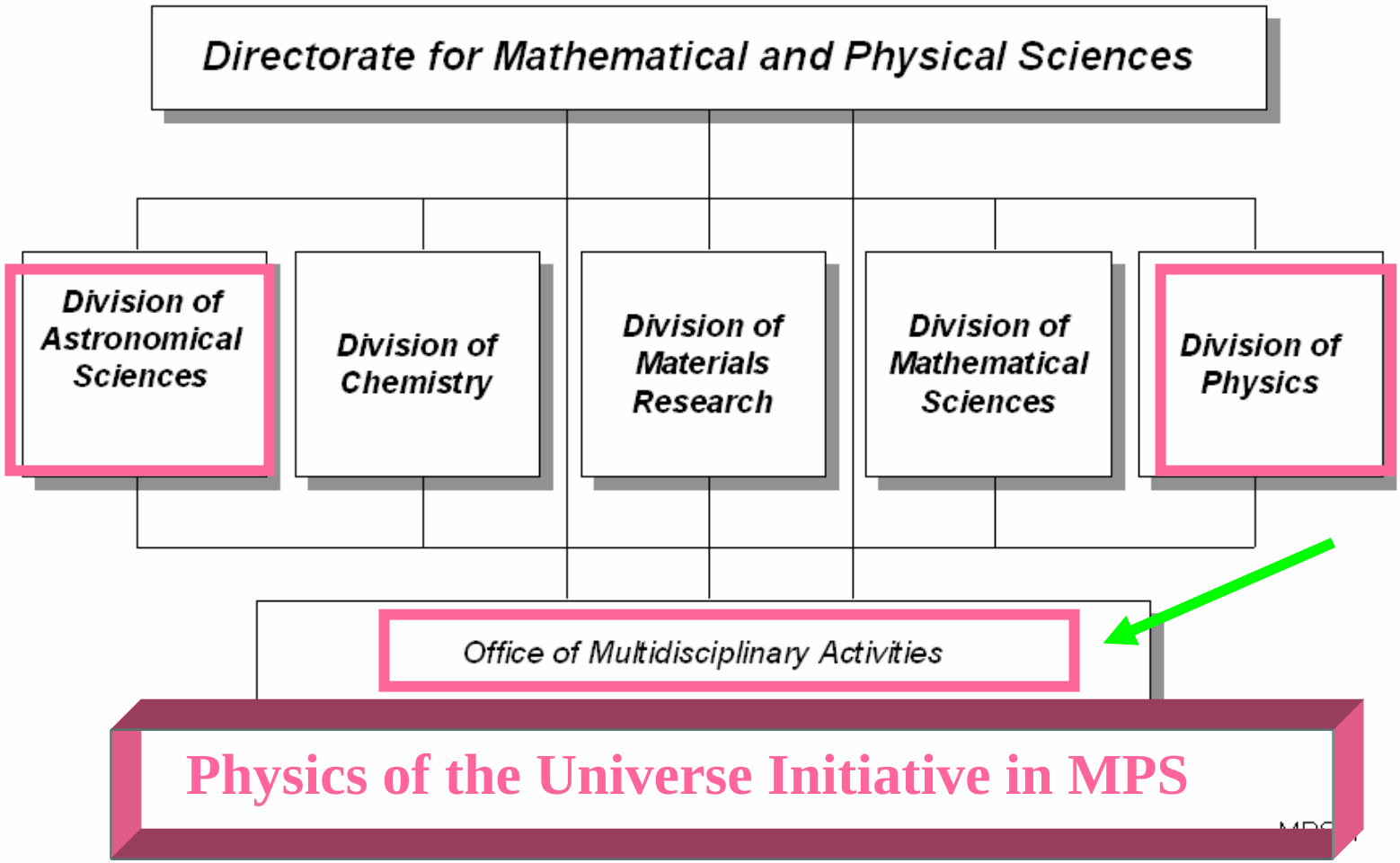


NSF FY 00-05 Budget Summary

	FY 2000 ($ millions)	2001	2002	2003	2004	2005 (Request)	%Diff
NSF	3,923.4	4,459.9	4,774.1	5,369.3	5,577.8	5,745.0	3.0
MPS	755.88	854.08	920.42	1040.70	1091.51	1115.50	2.2
PHY	168.30	187.54	195.88	224.50	227.67	235.76	3.6
EPP BASE	55.48	64.33	60.64	66.99	70.80	←	

"EPP BASE" : Theory + Astro + Accel. Based +Cornell

EPP has had an increase; funding the LHC research program (stabilized- MPS help) and RSVP advanced planning.

"Effective" Funding (>$100M) for Particle Physics in FY02 - FY04:

	FY02	FY03	FY04
Accelerator-based activities w Cornell	$41.58 M	47.97	50.94
Particle Astrophysics (SPINOFF)	9.05	9.86	10.83
EP-Astro Theory	10.01	9.16	9.03
Total Base	$60.64	66.99	70.80 M

PLUS

EPP Allied Funding	FY02	FY03	FY04	FY05
PFC $	4.0	4.0	4.0 M	
ITR	6.0	6.6	4.2	
MRI	3.2	1.7	0	
ESIE	0.7	0.7	0.29	
MREFC				Request
LHC construction $	16.90	9.69 M	----	----
IceCube	15.00	24.54	41.75	33.40 M
RSVP	--	--	--	30.00 M
Subtotal	$45.80	47.23	50.25	63.40 M

WE LEARN FROM EVOLUTION OF MAJOR PHYSICS PROJECTS

Cornell/CESR: Very Productive,Self Managed Laboratory; b, now c quark physics.

LIGO: *First* MREFC PROJECT; Gravitational Waves

LHC: *First* NSF Project Partnership at a European Laboratory. Energy Frontier.

RSVP: *First* NSF Project Leadership at a National Laboratory. Sensitivity Frontier.

First Projects in *Harsh Environments*- **ICE CUBE**, Future Underground Lab?

EPP RELATED: RED

The *LARGE HADRON COLLIDER (LHC)* will be the premier *Energy- Frontier* facility in the world, with vast discovery potential in elementary particle physics research.

A total of 34 international funding agencies participate in the *ATLAS* detector project, and 31 in the *CMS* Detector project

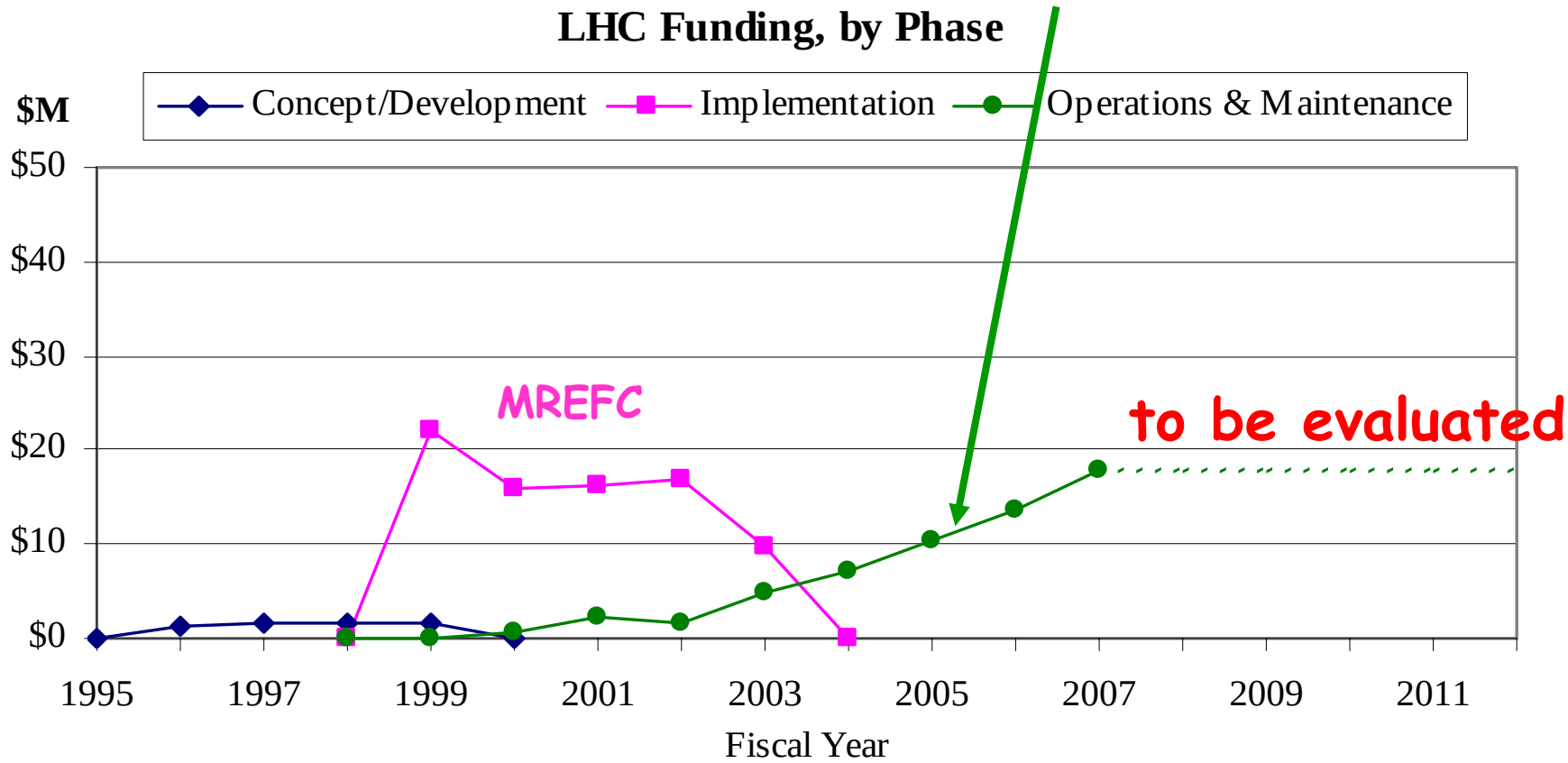
The U.S. participants are ~20% of the collaboration

Necessary

U.S. Department of Energy and the National Science Foundation

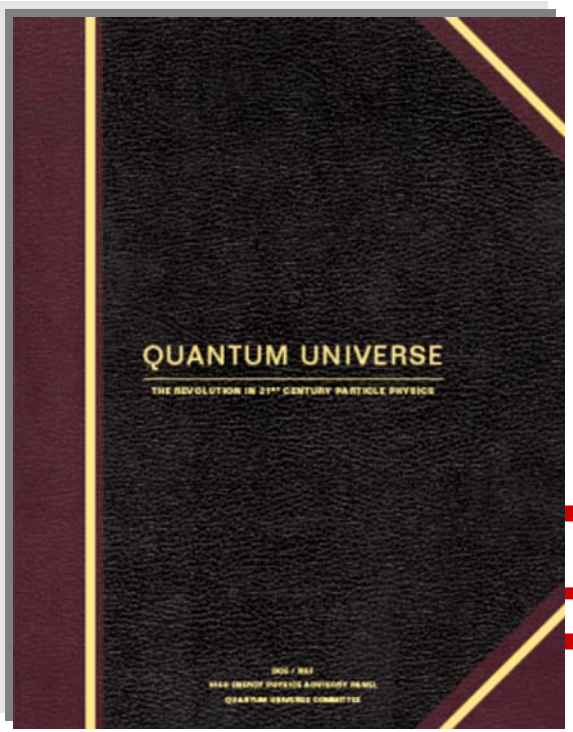
NSF US

LHC RESEARCH PROG (M&O/SW&C UP HILL!)



****DOE/NSF AGENCY AGREEMENT! Now more stable.**

****More funds through NEW CISE Division; SCI**



Primary US Physics Program of Smaller Facilities

	Unification				Particle World			Birth of the Universe	
Question	1	2	3	4	5	6	7	8	9
Mini-BooNE							X		
MECO	X				X				
Reactor Experiments							X		
CLEO-c					X				
K0PI0									X
Neutrinoless Double Beta Decay				X			X		
SDSS						X			
LSST		X				X			
Underground Dark Matter Detectors						X			
WMAP		X				X		X	
CMB Polarization								X	
Lattice Computational Facilities					X			X	
Precision Gravity			X						

1. Are there undiscovered principles of nature: new symmetries, new physical laws?

5. Why are there so many kinds of particles?

9. What happened to the antimatter?

The Rare Symmetry Violating Processes Project:

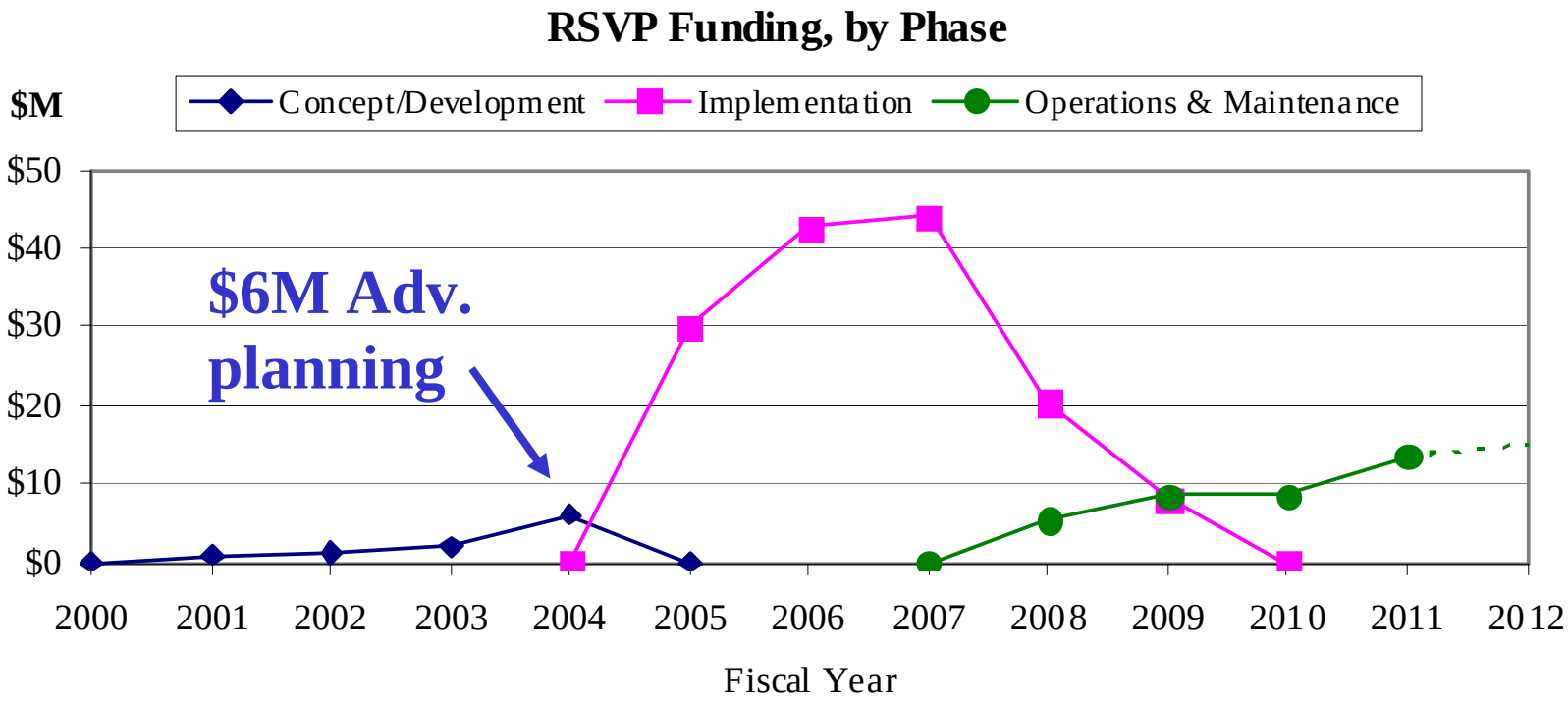
RSVP is an NSF-supported, university-led particle physics project, using accelerator facilities developed by DOE

KOPIO aims to measure a rare decay of the neutral kaon that would be a major advance in the study of CP violation and the matter-antimatter asymmetry in the universe $K_L^0 \rightarrow \pi^0 \nu \bar{\nu}$

MECO is a search for the "forbidden" conversion of muons to electrons that aims to discover new physics beyond SM up to 3000TeV $\mu^- N \rightarrow e^- N$

RSVP FUNDING

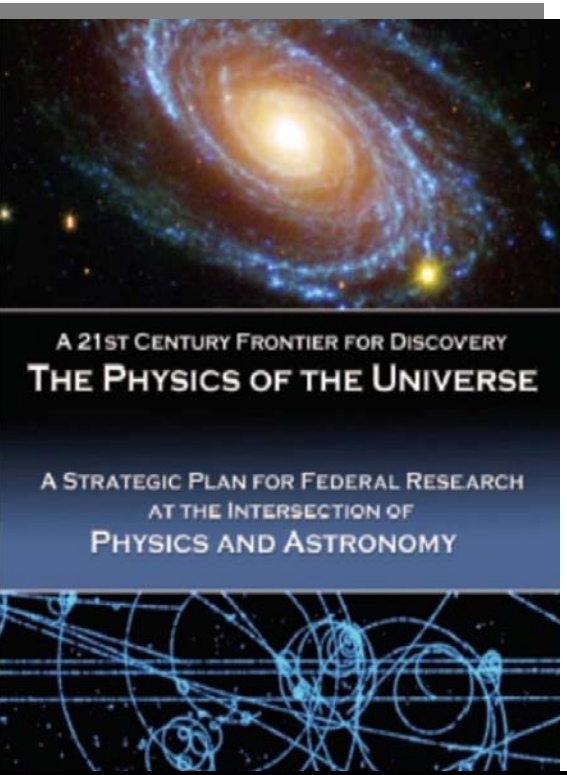
- Oct 2000: Director included RSVP as a future MREFC (2002+)
- President's FY2004 Budget put RSVP to start in FY2006
- Congress appropriated "$6M for continued advanced planning"



FY 2005 start shown, as in FY 2005 President's budget.

RSVP STATUS

- RSVP Project Leadership has been established
- Major reviews of components have been scheduled



Grid2003: An Operational Grid

- 28 sites (2100-2800 CPUs) and growing
- Running since October 03 - Sharing Resources

iVDgL

GriPhyN Data Intensive Science

PPDG

ADDING VALUE WITH CISE/EHR/OISE

QuarkNet

Proposal Review Criterion: *Broader Impacts*

- Advancement of discovery and understanding while promoting teaching, training and learning
- Participation of underrepresented groups
- Enhancement of infrastructure for research and education
- Dissemination of results to enhance scientific and technological understanding
- Benefits to society

NSF-13

Open Science Grid

PHYSICAL SCIENCES
INFORMATION TECHNOLOGY
EDUCATION

UNDERSTANDING THE UNIVERSE
Education & Outreach

Underground Science Laboratory Update

- **NAS BOARD ON PHYSICS AND ASTRONOMY, DEC 2002 *SUMMARY:***

"A deep underground laboratory can house a new generation of experiments that will advance our understanding of the fundamental properties of neutrinos and the forces that govern elementary particles, as well as shedding light on the nature of the dark matter that holds the Universe together. Recent discoveries about neutrinos, new ideas and technologies, and the scientific leadership that exists in the U.S., make the time ripe to build such a unique facility." http://www7.nationalacademies.org/bpa/Neutrinos_Sum.pdf

MPS/PHY is taking the lead for NSF, in partnership with the Directorates of Geosciences and Engineering, in working to implement a sequence of steps that might lead to the creation of such a laboratory

Underground Science Laboratory Update

NSF had an open meeting on May 19-20, 2003.
At this meeting: 3 Solicitations were announced:

1. Develop the scientific and engineering case for the range of potential experiments needing underground access (the Elements)
2. Describe the associated technical requirements on the infrastructure and instrumentation
3. Group the Elements with similar scientific motivation and associated technical requirements for infrastructure into Modules

Underground Science Laboratory Update

1. 04-595 (Deadline: September 15, 2004):
   The primary purpose of this solicitation is to establish the site-independent scientific and engineering benchmarks against which the capabilities of the candidate sites for an underground laboratory will be measured.
   (Expect 1-3 awards, each of up to $0.5M)

2. (No number yet; Deadline: December ??, 2004):
   This solicitation will invite proposals to support development of the conceptual design for the infrastructure, and an initial suite of experiments, for a Deep Underground Science and Engineering Laboratory. (Expect 1-4 6-month awards, each of up to $0.5M, in FY05)

HOUSE VA, HUD APPROPRIATORS RECOMMEND TWO PERCENT DECREASE FOR NSF (7-22)

NSF Funding by Appropriation						
(Dollars in Millions)						
	FY 2004	FY 2005		House Mark	Change over '04	
	Estimate	Request			$	%
Research and Related Activities	4,251.36	4,452.31	←	4,151.75	-99.62	→ -2.3%
Education and Human Resources	938.98	771.36		842.99	-96.00	-10.2%
Major Research Equipment	154.97	213.27		208.20	53.23	→ 34.3%
and Facilities Construction						
Salaries and Expenses	218.70	294.00		249.97	31.27	14.3%
National Science Board	3.88	3.95		3.95	0.07	1.8%
Office of Inspector General	9.94	10.11		10.11	0.17	1.7%
Total, NSF	$5,577.83	$5,745.00		$5,466.96	-$110.87	-2.0%
Totals may not add due to rounding.						

HOUSE MARKUP OF NSF MREFC

Subcommittee

MREFC Account					
(Dollars in Millions)					
	FY 2003 Actual	FY 2004 Estimate	FY 2005 Request		House Mark
ONGOING PROJECTS					
ALMA Construction	29.81	50.70	49.67		49.70
EarthScope: USArray, SAFOD, PBO	29.81	43.24	47.35		47.30
IceCube Neutrino Observatory ←	25.75	41.75	33.40	→	51.20
NEW STARTS					
National Ecological Observatory Network			12.00	→	0.00
Scientific Ocean Drilling Vessel			40.85	→	30.00
Rare Symmetry Violating Processes ←			30.00	→	30.00
Totals	**$179.03**	**$154.97**	**$213.27**		**$208.20**
NOTE: Totals may not add due to rounding.					

Senate Appropriations Committee (September 22, 2004)

($M)	Approp 2004	Request 2005	Comm Rec	Chng (%)
NSF Total	5578.32	5744.69	5744.69	2.98
R&RA	4251.36	4452.31	4402.32	3.55
MPS	1091.51	1115.5	1123.09	2.89
MREFC **No new**	154.98 **starts!**	213.27	130.42	-15.8

Summary

- We are working with many partnerships to bring added value to EPP projects
- We are entering a new phase of operations with facilities (some with DOE)